

WHAT IS CLAIMED IS:

1. An ablation catheter comprising:
 - an elongate flexible member; and
 - a conductive ablating surface on a distal portion of the member, the surface having a resistance that increases exponentially along its length from a center to a non-infinite value at opposite ends of the surface.
2. The device as in claim 1, and further comprising:
 - an electrical conductor extending within the member and having proximal and distal ends, wherein the proximal end of the conductor is adapted for connection to an external power source and the distal end of the conductor is connected to the conductive ablating surface.
3. The device as in claim 1, wherein the conductive ablating surface is adapted to produce a generally even temperature profile along a length of its surface when the surface is in contact with a target tissue within a patient's body and an electrical ablating signal is applied to the ablating surface.

4. The device as in claim 1, wherein the conductive ablating surface comprises a plurality of electrically connected conductive regions which extend from the center of the conductive ablating surface to a first and a second end of the conductive ablating surface.

5. The device as in claim 4, wherein the electrical conductor comprises a single electrically conductive wire.

6. The device as in claim 4, wherein the electrical conductor comprises a plurality of electrically conductive wires.

7. The device as in claim 1, wherein the ablating surface defines at least three electrically conductive regions of resistance including a first region having a resistance with a value of a first order of magnitude, a second region having a resistance with a value of a second order of magnitude, and a third region having a resistance with a value of a third order of magnitude, with the first region disposed closest to the center of the ablating surface and the third region disposed closest to one end of the ablating surface.

8. The device as in claim 7, wherein the resistance value of the first region is about 0 ohms per centimeter, the resistance value of the second region is about 10 ohms per centimeter, and the resistance value of the third region is about 100 ohms per centimeter.

9. The device as in claim 8, wherein the ablating surface has length of about four centimeters and the first region has a length of about 1.3 centimeters that extends from the center of the ablating surface towards one of the ends of the surface, the second region has a length of about 0.4 centimeters that extends from first region toward the end of the ablating surface, and the third region has a length of about 0.3 centimeters that extends from the second region to the end of the ablating surface.

10. The device as in claim 7, wherein the resistance value of the first region is about 50 ohms per centimeter, the resistance value of the second region is about 250 ohms per centimeter, and the resistance value of the third region is about 1250 ohms per centimeter.

11. The device as in claim 10, wherein the ablating surface has length of about one centimeter and the first region has a length of about 0.35 centimeters that extends from the center of the ablating surface towards one of the ends of the surface, the second region has a length of about 0.10 centimeters that extends from first region toward the end of the ablating surface, and the third region has a length of about 0.05 centimeters that extends from the second region to the end of the ablating surface.

12. The device as in claim 7, wherein the first region has a length of about 65 to 70 percent of the length of the ablating surface that extends from the center of the ablating surface towards one of the ends of the surface, the second region has a length of about 20 percent of the length of the ablating surface that extends from the center toward the end of the surface, and the third region has a length of about 10 to 15 percent of the length of the ablating surface that extends from the center to the end of the surface.

13. A device for ablating tissue within a patient's body comprising:
an elongate body; and
a linear electrode attached to the body wherein the linear electrode has a midpoint and opposite ends, wherein a resistance of the linear electrode

increases exponentially along a length of the electrode from the midpoint to a non-infinite value at the ends of the electrode.

14. The device as in claim 13, wherein the linear electrode is adapted to produce a generally even temperature profile along its length when in contact with a target tissue within a patient's body and an electrical ablating signal is applied to the linear electrode.

15. The device as in claim 13, wherein the temperature is substantially equal from the first end of the linear electrode to the second end of the electrode when power is supplied to the electrode.

16. The device as in claim 13, wherein the power source is external the body.

17. The device as in claim 13, wherein the electrode comprises a plurality of electrically connected conductive regions.

18. The device as in claim 17, wherein the plurality of conductive regions extend from the midpoint portion of the electrode to the opposite ends of the electrode and wherein a value of the resistance of each of the plurality of conductive regions increases in successive orders of magnitude from the midpoint to the opposite ends of the electrode.

19. The device as in claim 13, wherein the electrode defines at least three electrically conductive regions of resistance including a first region having a resistance with a value of a first order of magnitude, a second region having a resistance with a value of a second order of magnitude, and a third region having a resistance with a value of a third order of magnitude, with the first region disposed closest to a midpoint of the electrode and the third region disposed closest to one end of the electrode.

20. The device as in claim 19, wherein the first region has a length of about 65 to 70 percent of the length of the electrode that extends from the midpoint of the electrode towards one of the ends of the electrode, the second region has a length of about 20 percent of the length of the electrode that extends from the midpoint toward the end of the electrode, and the third region has a length of about 10 to 15 percent the length of the electrode that extends from the midpoint to the end of the electrode.

21. The device as in claim 20, wherein the resistance value of the first region is about 0 ohms per centimeter, the resistance value of the second region is about 10 ohms per centimeter, and the resistance value of the third region is about 100 ohms per centimeter.

22. The device as in claim 20, wherein the resistance value of the first region is about 50 ohms per centimeter, the resistance value of the second region is about 250 ohms per centimeter, and the resistance value of the third region is about 1250 ohms per centimeter.

23. The device as in claim 13, and further comprising:

an electrical conductor within the catheter body wherein the electrical conductor has proximal and distal ends and wherein the proximal end of the conductor is adapted for connection to a power source and the distal end of the conductor is connected to the linear electrode.

24. The device as in claim 23, wherein the electrical conductor is connected to a substantially central region of the electrode.

25. The device as in claim 23, wherein the electrical conductor comprises a single electrically conductive wire.

26. The device as in claim 23, wherein the electrical conductor comprises a plurality of electrically conductive wires.

27. The device as in claim 13, wherein the linear electrode has a first section with a generally uniform resistivity and a second section closer to the end with a resistivity that increases exponentially without approaching infinity at the ends.

28. The device as in claim 13 wherein the linear electrode has more than one section with each section having a constant resistivity throughout their length and the sections being arranged in series with each successive section beginning from the midpoint of the electrode toward the ends of the electrode having a resistance value that is one order of magnitude higher than the immediately adjacent section closer to the center of the electrode.

29. The device as an claim 28 wherein the linear electrode has at least three sections extending in each direction from the center of the electrode.

30. The device in claim 13 wherein the linear electrode has more than one section with each section having a resistivity that increases along their length and the sections being arranged in series with each successive section beginning from the midpoint of the electrode toward the ends of the electrode having a resistance value that is one order of magnitude higher than the immediately adjacent section closer to the midpoint of the electrode.

31. The device in claim 13 wherein the linear electrode has a first section having an constant resistivity and one or more sections having resistivity which increases along their length, with the sections arranged in series and the first section disposed closest to the midpoint of the electrode and having a resistance value that is at least one order of magnitude lower than the one or more sections having increasing resistivity.

32. A device for ablating tissue within a body comprising:
an elongate catheter; and
means for producing an ablating signal on a conductive distal surface of the catheter with the distal surface having a resistivity that increases exponentially to a non-infinite value along the length of the distal conductive ablating surface from a center of the surface to at least one end of the surface.

33. A method of ablating target tissue within a body, the method including the steps of:

positioning a linear electrode of a catheter in the body adjacent the target tissue; and

ablating the target tissue with the electrode at a generally uniform temperature along a length of the electrode.

34. The device as in claim 33, wherein the ablating step further comprises:
applying an electrical ablating signal to the electrode over a resistance of the electrode that increases in value exponentially along a length of the electrode from a midpoint to a non-infinite value at the ends of the electrode.

35. The device as in claim 34, wherein the applying step further comprises:
arranging at least three electrically conductive regions of resistance in series including a first region having a resistance with a value of a first order of magnitude, a second region having a resistance with a value of a second order of magnitude, and a third region having a resistance with a value of a third order of magnitude, which further comprises disposing the first region closest to a center of the electrode and the third region disposed closest to one end of the electrode.

36. The device as in claim 35, wherein the further comprising:
extending the first region over a length of about 65 to 70 percent of the length of the electrode that extends from the center of the electrode towards one of the ends of the electrode;

extending the second region over a length of about 20 percent of the length of the electrode that extends from midpoint toward the end of the electrode; and

extending the third region has a length of about 10 to 15 percent the length of the electrode that extends from the center to the end of the electrode.

37. The device as in claim 36, wherein extending steps further comprise:

providing the first region with a resistance value of about 0 ohms per centimeter;

providing the second region with a resistance value of about 10 ohms per centimeter; and

providing the third region with a resistance value of about 100 ohms per centimeter.

38. The device as in claim 36, wherein extending steps further comprise:

providing the first region with a resistance value of about 50 ohms per centimeter;

providing the second region with a resistance value of about 250 ohms per centimeter; and

providing the third region with a resistance value of about 1250 ohms per centimeter.

39. A method of producing a linear lesion along a target tissue comprising:
- positioning a linear electrode in the body adjacent the target tissue; and
 - heating the target tissue with the electrode at a generally uniform temperature along the length of the electrode without necrosing healthy tissue surrounding the target tissue.
40. The method of claim 39 wherein the heating step further comprises:
- applying an electrical ablating signal to the electrode over a resistance of the electrode that increases in value exponentially along a length of the electrode from a midpoint to a non-infinite value at the ends of the electrode.
41. An ablation catheter comprising:
- an elongate flexible member;
 - an electrode disposed on a distal portion of the member and defining a plurality of electrically connected conductive regions which extend from the center of the electrode to a first end and a second end of the electrode with all of the conductive regions having substantially the same resistance value;

a plurality of conductors, each conductor having a distal end connected to one of the conductive regions of the electrode and extending through the elongate flexible member to a proximal portion of the member; and

an external control unit having multiple voltage outputs with each voltage output having a different value wherein each voltage output is connected to a proximal end of one of the conductors,

wherein the conductive regions along the electrode produce a voltage pattern that decreases at the edges of the electrode.

42. An ablation catheter comprising:

an elongate flexible member;

an electrode disposed on a distal portion of the member and defining a plurality of electrically connected conductive regions which extend from the center of the electrode to a first end and a second end of the electrode;

a plurality of conductors, each conductor having a distal end connected to one of the conductive regions of the electrode and extending through the elongate flexible member to a proximal portion of the catheter; and

an external control unit having a single voltage output connected to multiple resistors with each resistor having a different value, and each resistor being connected to a proximal end of one of the conductors.